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do not stem the press, but only change the species, and far out in the shallows rise the red-stemmed flowering spikes of the blue water-lobelia!

The little Sandpipers remain for some weeks dependent on their parents and unable to fly. I once saw a big sturdy youngster (which apparently I had almost walked over in hiding a few minutes before), running splendidly, with wagging hind-parts, and its parent still in attendance. In a second I was seen, and the youngster vanished, while the old bird flitted about and cried until it had apparently manœuvred the little one by skilful tactics to a safe distance. A fellow was cheeping loud up the rill, but ran swift and hid as soon as a human head appeared above the wall.

The Sandpiper is the commonest of the waders with us. To every tarn-side and lake-strand and island it comes in spring to nest. Why it gained the first part of its name would be hard to say, unless two letters were omitted and strand was meant. Summer Snipe is another and perhaps a better name.

Yet it hardly stays the summer out with us. Seven weeks ago the first comers came; in six weeks more all will be gone. They scarcely linger after the young are self-sustaining, and away they go down the river as the water flows, and perhaps like it to the sea. Towards the close of July the sweet pipers that peopled our lake strands in the prime of the year have vanished.

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# ELEMENTARY SCIENCE-TEACHING.*

## By Mary Everest Boole.

If anyone here is expecting from me hints as to special devices for teaching the elements of sciences to children, I must begin by apologizing for a misconception which may have been caused by the title chosen for our discussion. It would be strange indeed if I could suggest any plans better than those which have been evolved by experienced teachers; I have not the presumption to attempt any such task, and I have to speak of something very different. A few thoughtful parents have said to me that they wish their children, while learning the elements of sciences, could also gain an early initiation into those methods of study by following which the Newton, or Darwin, or Faraday, or Thompson of the future trains himself after his teachers have done with him. The methods in use at schools ought, they think, to differ from the Newton, Darwin, Faraday methods of private study, only as the little sapling, which still needs support and shelter, differs from the tree. It seems a not unreasonable desire that the sapling of early method should have some natural tendency towards growing into that particular tree, true science-method. Whereas, so far as I can learn, all recognized school methods differ from the essential science-method rather as the little rose bush or cabbage differs from the oak; the cabbages and rose bushes may bring forth results admirable, charming, and vigorous, which will be good to eat, pleasant to the eye, and productive of prizes at shows; but they have no sort of tendency to grow into an oak; and if we happen to want to plant an oak-tree in the place where they have been set, we shall have to grub up the roses and cabbages. The youth who means to make scientific philosophy his career usually has to begin by grubbing out of himself what he learned at school—not of course *all* the statements about fact, and still less the good habits of order and industry, but all that he learned at school in the way of *method of study*. There *are* schools to which this sweeping criticism does not apply; here and there a teacher of elementary science evolves unconsciously, by some accident of organization or instinct, the true secret of the Newtons and Darwins. The pupils of such teachers are not always particularly successful in their early studies, for a reason which I will explain further on; the sapling does not grow fast, owing to uncongenial surroundings; but it is of the true breed, and, though a starveling, sound at the core. But scientific method is something more definite than the occasional and unconscious action of a heaven-born teacher; it might be, and ought to be, explained by lecturers on pedagogic to audiences of intelligent pupil-teachers. I have been told, on good authority, that the essence of scientific method is never formulated in lectures addressed to, or text-books intended for, young teachers. It is this task which I propose to undertake. I will not waste your time over any theories or would-be original ideas of my own; but will simply state as plainly as I can a principle which has been formulated in scientific treatises on the Art of Study, such as that of Gratry, and which is so recognized in the circles where science is being evolved as to be held a matter of course not needing to be stated at all, unless when some science leader is roused to protest by the proceedings of those around him. An instance of such protest may as well be given now. Nearly forty years ago a lady asked me to lend her some good introduction to the study of nature. I lent her a work which had been the delight of my own childhood; but she promptly returned it with a note to the effect that she could not allow her children to read it, for it was antiquated and not up to modern requirements; it stated that herring schools approach Europe from the North, whereas it had lately been discovered that they come from the South (or *vice versâ*—I do not at this moment remember which theory was held thirty-five years ago and which twenty years before that); and, she added, there is so much that children must learn nowadays that they must not waste their time in learning theories already exploded. A scientific man to whom I showed the letter remarked impatiently that the writer evidently had no idea what she was about; for, he said, what is most necessary for the children to learn is not what is the last new theory about where herrings are hatched, but how to extract the truth from a series of impressions and statements, each of which is only partially true. In this utterance we have, I think, the key to the most essential element in a truly scientific method of study; and the case is worth analyzing, for it illustrates the grave error, the cunningly hidden pitfall into which the advanced section of the educational profession fell in passing from the ancient ideal of an education based on classics to the modern ideal of an education based on science.

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* Address given at the St. John's Wood Branch of the P.N.E.U., Dr. Gladstone in the chair.

Dead languages are fixed for ever, at least as to those parts of the study with which young people are concerned. The dative of such a noun is so-and-so; this particular word is a dactyl and that a spondee; and the duty of the schoolmaster was to see that the boys spelled and scanned the words accordingly. My friend had been trained in the fundamental conception, that there is a right way of spelling a word, and other ways are wrong; and that children should be taught the right way. She had so far outgrown the old classic traditions as to think that a citizen of the nineteenth century should know how God makes the world and whence comes humanity's food; that it is not enough to know how Sallust spelled Latin and how Virgil scanned it; she had read enough science, too, to be aware that it, unlike Latin or Greek, is a growing, not a fixed and limited form of knowledge. She was not foolish enough to imagine she could get hold of any absolute and final opinions about science, to substitute for the absolute and final right ways of writing Latin; so she enshrined instead, on her domestic altar, the last new up-to-date opinion, having no conception of the true nature of eternal scientific method. What this lady did in detail, the advanced section of educationalists have done as a whole; when they discovered that fixed rules of grammar are not, as used to be thought, sufficient mind-food, they substituted, not the eternal truth of mental pulsation, but up-to-date-ness. The newest text-books, the latest opinion about evolution, the most newly-invented and costliest apparatus, the latest method of showing electric or galvanic action—these are supposed to be the characteristics of the best science school! Yet it is well known that many of our great scientific leaders learned at first from books old even in their childhood, and used simple apparatus of their own contriving for lack of means to purchase any other.

The main cause of the mistake seems to be this. It had been proved by the experience of many generations that the Classical Tripos Examinations at Universities tend to keep teachers up to thorough work; it was too hastily assumed that examinations would therefore be good in science. Providence had sent the world a small kind of warning beforehand; even in mathematics (though that differs from the natural sciences in being more settled)—even there the examination system was not entirely successful. The senior classic was a real scholar; but the senior wrangler was by no means always the really sound and philosophic mathematician. But that hint passed unheeded, and it was decided to flood the universities and the country with examinations in all sorts of sciences. Now in a rapidly progressing science there is comparatively little that an examiner can test for, except knowledge of the last new hobby.

In classical learning it is eminently desirable to secure that the right impression shall be made from the first; that wrong impressions shall have as little time as possible to deepen themselves. We wish the child's eye and ear to become accustomed from the first to welcome the right and reject the wrong; we do not wish them to gain any habit of tolerating wrong impressions. If the child uses the nominative where he should use the accusative, and is not at once corrected, that is so much to the bad for his future progress; if he can be got not to be able to remember a time when he used the word wrongly, that is so much to the good. But in science there are, there can be, no absolutely right impressions; our minds are not big enough to grasp any natural fact as a whole; everything depends on drawing right conclusions from combinations of impressions, each of which is in itself inadequate and partially misleading; and if the pupil is to be got into scientific methods, that is what he must be trained to do. And in order that he may learn to do it, it is sometimes necessary that each of a succession of "wrong" impressions should have time to register itself on the brain and become part of its available stock. Such a statement may naturally convey to the scholastic mind trained in classic traditions an impression of disorderliness, but it does not imply disorder. On the contrary, the haste, the greed, to efface rapidly each partial impression, when we have nothing to substitute for it but some other impression equally partial, is not only unscientific but eminently disorderly.

The difference between teaching sciences and training in scientific method is well illustrated in the teaching of botany and biology by dissecting flowers and animals. In the first place, as Professor Geddes constantly reminds his hearers, confusion of mind is induced by using the word "biology" to anything which involves destroying the life of the object under investigation. It is often necessary, for purposes of scientific investigation, to destroy life (though there need not be nearly as much of it as there is). But however necessary, it is at least in itself, not biology but necrology, for you are showing the pupil not how the thing lives, but how it looks when dying or dead. And this is more than a mere quibble about words—the whole question of scientific method is involved. Children inherit from their monkey-ancestors an abundant supply of inquisitive destructiveness; the quality which needs *educating*, *i.e.*, educing, is reverent patience to stand still and watch other creatures living their lives. Science has been evolved by the balanced action of these two faculties or powers—the natural monkey-inquisitiveness and the educated spiritual reverence. To over-cultivate destructive curiosity is a cheap way of enabling children to make a show in science examinations, but that sort of thing has no tendency to induce the habit of true scientific method, which depends on balance of opposites. If a child is to be initiated into scientific method, its early studies must go in the direction of *balancing* its natural destructiveness by learning to foster life and to patiently study the development of living things. Of course, this ideal is very difficult to carry on in town; it is, for instance, difficult to study botany in town except by means of cut flowers; but a good deal might be done by teaching children, when they see a flower, either growing or in water, not to touch it till they have learned all they can of its pose and mode of growth, so as to be able, after dissecting it, to reconstruct in their minds an accurate picture of how it looked before they disturbed it.

The tendency in science classes to an over-cultivation of mere monkey-destructiveness, has been largely fostered by the claim of certain faddists, that children shall be told nothing, but shall "find out everything for themselves." What science really does claim in this matter is that a clear line of demarcation shall be preserved between *what the individual has observed* and *what he has learned at second hand.* I am going back to this point presently.* The claim that children shall find out everything and be told nothing is palpably absurd.

As a matter of fact, most science leaders read eagerly and omnivorously on their own subject, being anxious to get all the help they can from previous or contemporary investigators. No man can find out for himself all he needs to know. How could any individual find out by himself the earth's movement round the sun? What science does claim is, that no child shall be told anything about the motion of the earth, till he has observed many sunrises and sunsets; till a clear sense-impression of the earth standing still and the sun moving has become organic within him. This registering of a "wrong" impression is what in science we have to secure; while in classics we should aim to prevent it.

Now, let us see how a true science teacher deals in detail with this scientific necessity for registering, separately, successive partial and misleading impressions. Her subject is, we will say, the buttercup. First, she gets the children to look carefully at the plant as a whole; if possible to watch it growing. If they can have a specimen in their garden, and watch the gradual unfolding of leaf and flower-buds, so much the better. If she can draw, she will teach them to register with the paint-brush their impressions of it at various stages. She will lead them to observe among other facts, that it differs from such flowers as the larkspur by having apparently no nectary. When they have carefully noticed all she can get them to see of the living plant, she proceeds to a dissection of the flower. "What is this?" she says,

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* In next number.

pointing to the scale at the base of a petal. "A bit of petal turned up," says one child. "A stamen with the anther knocked off," says another. "I think it looks like a little petal, like the inside petals of a double anemone," says some specially observant little person. If the teacher is a mere crammer, she will immediately explain the function of the scale; but if she is a real science-teacher, she makes no comment, she only asks questions to draw out further observations.

Some other day she will explain that the scale is believed to secrete some substance and, therefore, to partake of the nature of a nectary. But if she is wise she will not do this till the conception of an anomalous organ, as to which one could not be sure whether it is a petal or a stamen, has had time to stamp itself well in. Then, when the children learn that it is after all a sort of nectary, though it is not the shape of one, only that it is not called nectary because the substance it secretes is not honey, this will be a real introduction for them to the conception of metamorphism. It will not enable them to answer questions at examination on Goethe's theory of metamorphism, still less on any later one; but it will prepare them to understand metamorphism as Goethe understood it, by leading them to see nature as Goethe saw it. Meantime, if the up-to-date mother or head-mistress has been present at the former part of the lesson, this is the kind of comment she will probably make:—"Miss Dash came to us with the character of a high-class science teacher; but I am disappointed in her; she is so dull and behindhand; she constantly lets mistakes pass. Only to-day I heard Bessie call the little scale of the buttercup a bit of petal, and Miss Dash seemed not to know any better; at any rate she said nothing. I am sure I read in the Botanists' Magazine nearly two years ago that the scale is considered to be a secreting gland. It is very provoking after all the pains I took to secure good teaching in that department."

Such is the kind of misapprehension which has come of trying to put the new wine of scientific progress into the old bottle of academic preparing for examination. A mistake in grammar is a mere blunder, and should be corrected as soon as possible, so as to prevent the child's eye and ear becoming accustomed to, and contented with, inelegant diction. This was the function of the old classical teachers, and the examinations kept them to their function. But the misapprehension about the gland is not a blunder; it is the normal impression which the phenomena should naturally make on a mind at a certain stage of development, and it is the teacher's business to ensure that her pupil's mind shall register that impression before being disturbed by the intrusion of one derived from more recondite investigations. If, indeed, the child were, from carelessness, to make what is for him, at his present stage, a blunder, she would immediately lead him by questions to see his error; but that is quite another matter. In arithmetic—the most methodized of sciences—we make the child correct his sum if he has made a careless mistake; but no good teacher interrupts a partial apprehension till the normal time has come. Natural science is so complex a growth that it is hardly possible to test, by any sort of examination, whether the elementary teacher is or is not carrying on his work aright; and it is therefore, in my opinion, a subject which should be left out of any scheme of examinations for elementary schools.

*(To be continued.)*

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## OUR WORK.

Business letters addressed to the Principal *re P.N.E.U., Parents' Review School, House of Education*, and *Mothers' Educational Course*, cannot be answered between August 1st and September 15th, during which time the House of Education will be closed.

*The Office* will be closed from August 1st to September 15th. Any letters requiring an answer may be addressed to Mrs. Franklin, 9, Pembridge Gardens, W.

*House of Education.*—Next term begins Saturday, October 1st. Ladies wishing to enter in January should apply as soon as possible for form of entry.

"*Meditations.*"—Will subscribers send 1*s.* to Mr. George Middleton, Ambleside, for the next term's "Meditations," before October 1st. We should be grateful if more friends would subscribe. The back numbers for two terms may be had for an additional 1*s.* 3*d.* sent to Mr. Middleton.

*Parents' Review School.*—Intending Members of the *Parents' Review* School should apply for papers immediately, or on September 15th at the latest; but not between August 1st and September 13th. The School term begins September 15th.

*Parents' Review Translation Society.*—A few more members are needed. Fee 1/6 per annum. For particulars apply to Miss C. A. Rooper, Pen Selwood, Gervis Road, Bournemouth.

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## THE "P.R." LETTER BAG.

[*The Editor is not responsible for the opinions of Correspondents.*]

OUR readers will like to see the reply of H. Wilson, Esq., the artist who designed the beautiful certificate (Mrs. Dallas Yorke's gift to the House of Education), to the numerous students who have asked for an explanation of the design:—

"I have so often been asked for explanations of the meaning of the Certificate for the House of Education, which I had the honour of designing, that I have attempted briefly to set down what were my intentions in making that design. There is, however, a rooted objection in the minds of most artists to explaining the meaning of their works, and I think for a very natural reason. The artist is practised in one art and has given expression to his ideas in that art. To express those ideas again in another art, adequately, demands a labour from which most shrink even though they may have the leisure. There is another reason—that the art of literature, which is designing in words and sounds, has, in power of suggestion, so many advantages over other graphic or glyptic arts, that